

FORM PTO-1390  
(REV 10-95)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

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**TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. §371**

MERCK 2245

U.S. APPLICATION NO. (If known, see 37 CFR §1.5)

09/856661

INTERNATIONAL APPLICATION NO

INTERNATIONAL FILING DATE

PRIORITY DATE CLAIMED

PCT/EP99/08821

17 NOVEMBER 1999

24 NOVEMBER 1998

TITLE OF INVENTION

INTERCONNECTION SUPPORT FOR PLATE-LIKE MICROCOMPONENTS

APPLICANT(S) FOR DO/EO/US

HOHMANN, Michael, et al.

**Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:**

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. §371.
  2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. §371.
  3. ☐ This express request to begin national examination procedures (35 U.S.C. §371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. §371(b) and PCT Articles 22 and 39(1).
  4. ☒ A proper Demand for International Preliminary Examination was made by the 19<sup>th</sup> month from the earliest claimed priority date.
  5. ☒ A copy of the International Application as filed (35 U.S.C. §371(c)(2))
    - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
    - b. ☒ has been transmitted by the International Bureau.
    - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
  6. ☐ A translation of the International Application into English (35 U.S.C. §371(c)(2)).
  7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3))
    - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
    - b. ☐ have been transmitted by the International Bureau.
    - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
    - d. ☒ have not been made and will not be made.
  8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. §371(c)(3)).
  9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. §371(c)(4)).
  10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. §371(c)(5)).
- Items 11. to 16. below concern document(s) or information included:**
11. ☐ An Information Disclosure Statement under 37 C.F.R. §§1.97 and 1.98.
  12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. §§3.28 and 3.31 is included.
  13. ☐ A FIRST preliminary amendment.  
☐ A SECOND or SUBSEQUENT preliminary amendment.
  14. ☐ A substitute specification.
  15. ☐ A change of power of attorney and/or address letter.
  16. ☐ Other items or information:

Form PTO-1390

APPLICATION DATA SHEET

APPLICATION INFORMATION

Application Date:: 05/24/01  
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Title:: INTERCONNECTION SUPPORT FOR PLATE-LIKE  
MICROCOMPONENTS  
Attorney Docket Number:: MERCK 2245

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CORRESPONDENCE INFORMATION

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REPRESENTATIVE INFORMATION

Representative Customer Number:: 23599

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Interconnection support for plate-like microcomponents

The invention relates to an interconnection support for plate-like microcomponents.

Plate-like microcomponents, such as micromixers, micro-pumps, microvalves or the like, serve for carrying out chemical reactions with extremely small mass flow rates. The use of microcomponents enables precise temperature control and good mixing, enabling significantly more accurate process control at the same time as increased safety.

The microcomponents usually consist of a plurality of plane-parallel plates lying one on top of the other which contain structures in their surfaces lying one on top of the other which are necessary for the requisite function. Owing to good thermal conductivity and structurability, these plates usually consist of silicon (silicon wafers) which contain in the interior a geometry matched to the function of the microcomponent. However, it is also possible to use other, chemically resistant materials matched to the use conditions.

Hitherto, primarily individual microcomponents, usually with a plate-like design, have been employed and in each case provided individually with the inlet and outlet lines for liquid and gaseous components and - if necessary - with electrical connections. However, an essential aspect of the use of such microcomponents is connection to standard laboratory equipment so that the advantages of microsystems can be employed on a laboratory scale.

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The object of the invention is therefore to provide an interface between microtechnology and laboratory technology via which the microsystems can be adapted reliably and simply to standard laboratory equipment.

This object is achieved in accordance with the invention by an interconnection support for plate-like microcomponents having at least one support rail which is attached to a support plate and which has an insertion slot for the accommodation of an insertion edge of a plate-like microcomponent, with line connections which can be connected to associated connections in at least one outside of the plate-like microcomponent being provided in at least one of the two side walls of the insertion slot of the support rail.

With this interconnection support, a mechanically stable mount is also created at the same time as a connection system. The connection system enables supply with reagents and the implementation of an electrical connection, for example for measurement technology, heating, cooling, etc. The microcomponents can be connected in a simple manner and exchanged easily. The use of a plurality of support rails on a common support plate makes it possible to achieve spatially compact accommodation of a plurality of plate-like microcomponents. Universal connection technology of this type enables mechanically stable construction of microsystems with standardized supply technology in an extremely small space.

According to a preferred embodiment of the invention, it is provided that at least one of the side walls of the insertion slot has at least one threaded hole for the accommodation of a screw connection, which can be screwed against the associated outside of the plate-like microcomponent. This simultaneously achieves leak-

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proof connection of the microcomponent to the screw connection and at the same time reliable fixing of the plate-like microcomponent in the support rail.

In order to ensure precise and reliable alignment of the plate-like microcomponent in the support rail, it is provided, in a further embodiment of the inventive idea, that, at one end of the insertion slot, a spring is arranged which acts in the longitudinal direction of the slot and by means of which the plate-like microcomponent can be pressed against a centring stop at the other end of the insertion slot.

Electrical contact surfaces which can be brought into contact with associated electrical contacts of the plate-like microcomponent are arranged between the threaded holes or in the opposite side wall of the insertion slot. An electrical connection as is in many cases necessary for measurement sensors in the microcomponent, for heating, cooling or similar purposes, is thus formed at the same time.

In a further refinement of the inventive idea, it may be provided that the support rail is connected to a connection rail which extends perpendicular to the support plate and has an insertion slot for the accommodation of a further insertion edge of the plate-like microcomponent, with line connections which can be connected to associated connections in at least one outside of the plate-like microcomponent being provided in at least one of the two side walls of the insertion slot of the connection rail.

The connection rail rising vertically from the support rail offers firstly the possibility of providing further line connections there; secondly, this connection rail forms a stable mount for the inserted plate-

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like microcomponent, enabling other mounts and fixings to be omitted.

Further advantageous embodiments of the inventive idea are the subject-matter of further sub-claims.

Illustrative embodiments of the invention are explained below in greater detail and are shown in the drawing, in which, in each case in perspective view:

Fig. 1 shows an interconnection support for plate-like microcomponents with a support rail attached to a support plate,

Fig. 2 shows an interconnection support with additional connection rail, and

Fig. 3 shows an interconnection support with a connection holder separated from the support rail.

The interconnection support shown in Fig. 1 serves for the accommodation of a plate-like microcomponent 1. A support rail 2, consisting, for example, of plastic, is attached to a support plate 3. The support rail 2 has a longitudinally extending insertion slot 4, into which the plate-like microcomponent 1 can be inserted by means of a base strip 5. The base strip 5 is limited by lateral cut-outs 6, which butt against the ends of the insertion slot 4 and thus ensure precise definition of the insertion depth.

A spring 7, for example a leaf spring, which acts in the longitudinal direction of the insertion slot 4, is arranged at one end 4a of the slot and presses the base 5 of the plate-like microcomponent 1 against a centring stop 8 at the other end 4b of the insertion slot 4.



A plurality of threaded holes 10 which extend transversely to the plane of the plate-like microcomponent 1 and are each intended for the accommodation of a screw connection 10a, through which liquid or gaseous substances are fed to or discharged from the microcomponent 1, are provided in one side wall 9 of the insertion slot 4. After insertion of the microcomponent 1 into the insertion slot 4, the screw connections are screwed against the microcomponent 1 and thus pressed against connections 11 in the outside 1a of the plate-like microcomponent in a leak-proof manner.

Electrical contact surfaces 13, for example contact springs, are arranged in the side wall 12 of the insertion slot 4 which is opposite the side wall 9 and come into contact with associated electrical contacts 14 on the facing outer surface 1b after insertion of the microcomponent 1 and serve for electrical connection.

The illustrative embodiment in accordance with Fig. 2 differs from the illustrative embodiment in accordance with Fig. 1 essentially through the fact that the support rail 2 is connected to a connection rail 15 which extends perpendicular to the support plate 3 and likewise has an insertion slot 16 for the accommodation of a further insertion edge 17 of the plate-like microcomponent 1.

In the illustrative embodiment in accordance with Fig. 2, only the threaded holes 10 for the accommodation of the screw connections 10a are provided in the support rail 2 connected to the support plate 3. The electrical contact surfaces 13 described are only arranged in the connection rail 15 and serve for the connection of electrical leads 18.

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The illustrative embodiment in accordance with Fig. 3 differs from the illustrative embodiments described above essentially through the fact that a connection holder 19, which is separated from the support rail 2, which again has only the threaded holes 10 here, has an accommodation slot 20 for an edge 21 of the plate-like microcomponent 1. The electrical contact surfaces 13, which are in contact with the associated contacts 14 of the plate-like microcomponent 1, are arranged in the first side wall 20a of the accommodation slot 20.

The connection holder 19, which may also be connected or attached to the support plate 3 in a suitable manner, additionally fixes the accommodated microcomponent 1 or a plurality of such accommodated microcomponents 1.

In all the illustrative embodiments shown, a plurality of microcomponents 1 can be accommodated by the arrangement of a plurality of support rails 2 on a common support plate 3. Thus, multistep or even parallel reactions can be carried out in an extremely small space by connecting a plurality of microcomponents 1 in series.

## Patent Claims:

1. Interconnection support for plate-like micro-components having at least one support rail (2) which is attached to a support plate (3) and which has an insertion slot (4) for the accommodation of an insertion edge (5) of a plate-like microcomponent (1), with line connections (10, 10a, 13) which can be connected to associated connections (11 14) in at least one outside (1a, 1b) of the plate-like microcomponent (1) being provided in at least one of the two side walls (9, 12) of the insertion slot (4) of the support rail (2).

2. Interconnection support according to Claim 1, characterized in that at least one of the side walls (9) of the insertion slot (4) has at least one threaded hole (10) for the accommodation of a screw connection (10a), which can be screwed against the associated outside (1a) of the plate-like microcomponent (1).

3. Interconnection support according to Claim 1, characterized in that, at one end (4a) of the insertion slot (4), a spring (7) is arranged which acts in the longitudinal direction of the slot and by means of which the plate-like microcomponent (1) can be pressed against a centring stop (8) at the other end (4b) of the insertion slot (4).

4. Interconnection support according to Claim 2, characterized in that electrical contact surfaces (13), which can be brought into contact with associated

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electrical contacts (14) of the plate-like microcomponent (1), are arranged between the threaded holes (10) or in the opposite side wall (12) of the insertion slot (4).

5. Interconnection support according to Claim 1, characterized in that the support rail (2) is connected to a connection rail (15) which extends perpendicular to the support plate (3) and has an insertion slot (16) for the accommodation of a further insertion edge (17) of the plate-like microcomponent (1), where line connections (13) which can be connected to associated connections in at least one outside of the plate-like microcomponent (1) are provided in at least one of the two side walls of the insertion slot (16) of the connection rail (15).

6. Interconnection support according to Claim 5, characterized in that the support rail (2) has the threaded holes (10) for the accommodation of the screw connections (10a), and the connection rail (15) has electrical contact surfaces (13).

7. Interconnection support according to Claim 1, characterized in that a connection holder (19) which is separate from the support rail (2) has an accommodation slot (20) for an edge (21) of the plate-like microcomponent (1), and in that electrical contact surfaces (13), which can be brought into contact with associated contacts of the plate-like microcomponent, are arranged in at least one side wall (20a) of the accommodation slot (20).

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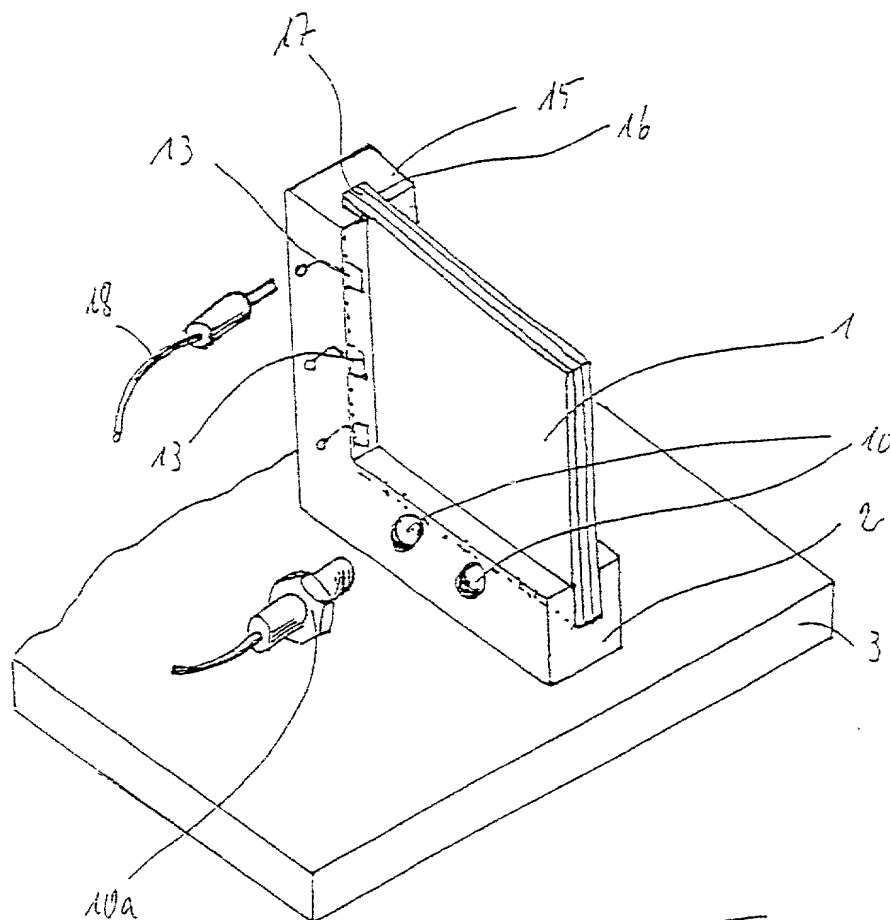
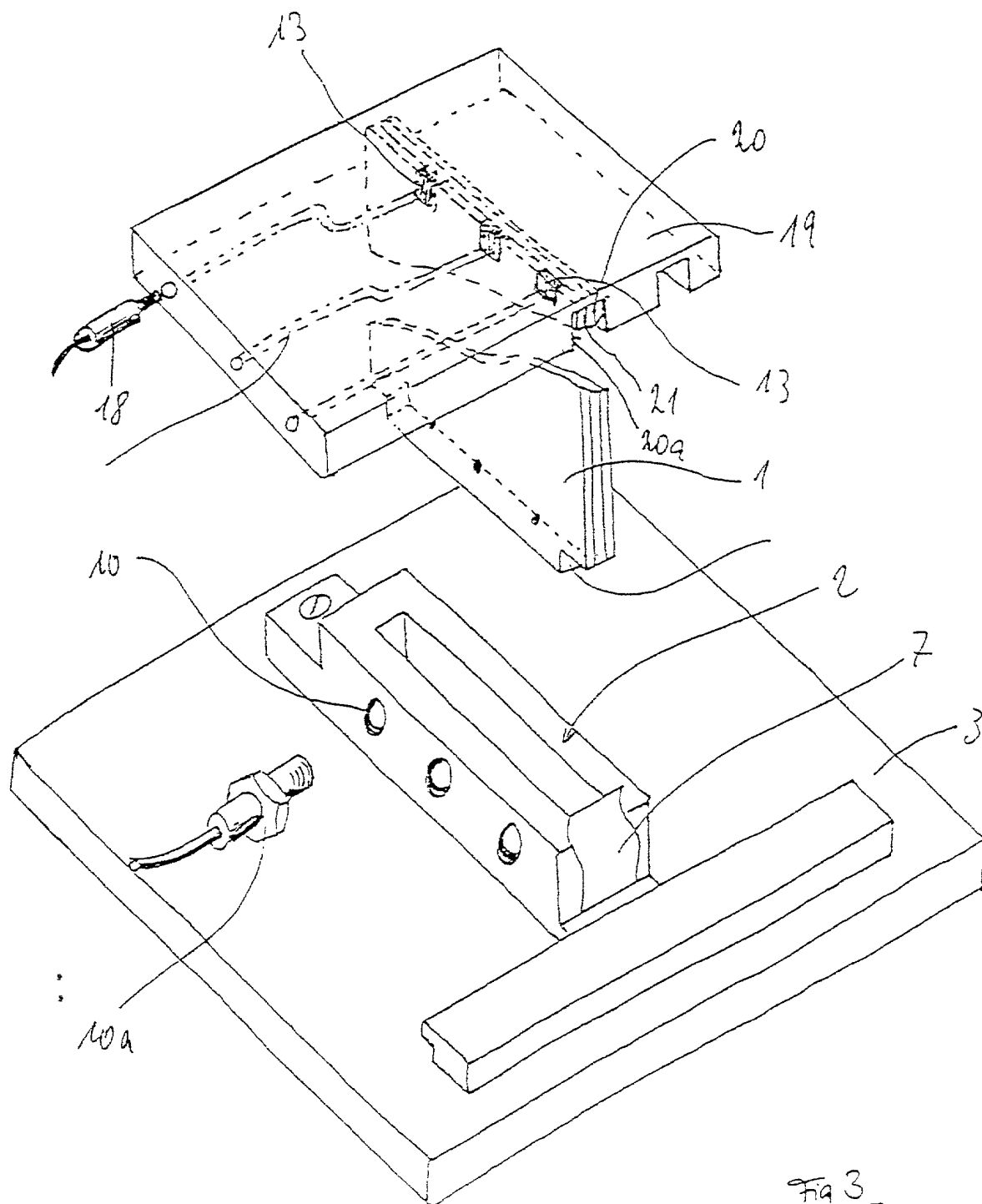


Fig. 2

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**DECLARATION FOR PATENT APPLICATION**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**INTERCONNECTION SUPPORT FOR PLATE-LIKE MICROCOMPONENTS**

the specification of which

☐ is attached hereto

☒ was filed on 17 NOVEMBER 1999 as United States Application Number or PCT International Application Number PCT/EP99/08821 and (if applicable) was amended on \_\_\_\_\_

I hereby authorize our attorneys to insert the serial number assigned to this application.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed

**PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 USC §119**

APPLICATION NO.	COUNTRY	DAY/MONTH/YEAR FILED	PRIORITY CLAIMED
198 54 096.5	GERMANY	24 NOVEMBER 1988	YES

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

**PROVISIONAL APPLICATION(S) UNDER 35 U.S.C. §119(e)**

APPLICATION NUMBER	FILING DATE

I hereby claim the benefit under 35 U.S.C. §120 of any United States application, or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. §112

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application

**PRIOR U.S./PCT INTERNATIONAL APPLICATION(S) DESIGNATED FOR BENEFIT UNDER 37 U.S.C. §120**

APPLICATION NO.	FILING DATE	STATUS — PATENTED, PENDING, ABANDONED

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith: I. William Millen (19,544); John L. White (17,746); Anthony J. Zelano (27,969); Arz E.J. Branigan (20,585); John R. Moses (24,983); Harry B. Shupin (32,004); Brian P. Heaney (32,542); Richard J. Travers (30,595); John A. Sopp (33,103); Richard M. Lebovitz (37,067); John H. Thomas (33,460); Cathenna M. Joyce (40,668); Nathaniel J. Axelrod (44,014); James T. Moore (35,619); James E. Ruano (37,432); Jennifer J. Branigan (40,921) and Robert McCarthy (46,044)

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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